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MINERALOGY AND PETROGRAPHY.[1]

Quartz and Feldspar Inclusions in Diabase.—Backström[2] has discovered in several Scandinavian diabases inclusions of quartz and feldspar, and has carefully studied the effects produced by the reactions between them and the enclosing rock magma. The diabase consists of labradorite, three augites, magnetite and several secondary substances, and has a structure that differs slightly from the diabasic structure, in that the angles between the plagioclase and the more or less columnar augite, are filled with a groundmass of feldspar laths, pyroxene needles, magnetite and chlorite. Near the quartz inclusions the quantity of the groundmass increases and the diabasic structure becomes obscure, until it finally disappears, and in its place is seen a porphyritic aggregate with thick tabular crystals of plagioclase, well formed augite prisms and large grains of magnetite in a groundmass that occupies a third or a half of the field of view. Very near the quartz the plagioclase become smaller, and spherulites of quartz and feldspar more abundant, of which the latter mineral is either orthoclase or oligoclase. The feldspathic inclusions in the rock are orthoclase, microline and plagioclase. The action of the magma upon the microline is shown in the existence in it of 'solution-spaces,' which are spaces dissolved from the midst of the mineral and afterwards filled with rock magma, from which have crystallized pyrite, magnetite, ilmenite, needles of pyroxene, lath-shaped crystals of oligoclase, grains of quartz, calcite and masses of chlorite. The orthoclase inclusions sometimes become granulated, or filled with long lenticular areas of a feldspar whose origin is the same as that of the minerals in the solution spaces. Plagioclase fragments have also undergone granulation, and the new feldspar has crossed the original twinning planes irrespective of their directions. Other fragments are more completely penetrated by the magma, so that everywhere throughout their mass may be detected small areas of the diabasic groundmass with its spherulites. The peripheries of the grains are often marked by growths of new, colorless, transparent plagioclase, crystallographically continuous with the enclosed mineral. Mica, hornblende and other iron-bearing compounds seem less capable of resisting the action of the

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bihang t. k. Svensk. Vet. Akad. Handl., B. 16, Afd. II, No. 1.

magma than the feldspar fragments. They are consequently often entirely dissolved, leaving behind them scarcely a trace of their former existence. When cores of these remain they are surrounded by magnetite, quartz (?) and sometimes newly formed biotite. Before closing his article the author calls attention to the differences in the action of diabasic and basaltic magmas upon enclosed fragments, the most noticeable being that in the former case no glass inclusions are developed in the material of the enclosed substances, while in the latter case these are abundantly formed.

The Basalts of Cassel.—Among the basaltic rocks occurring in the neighborhood of Cassel, Fromm[1] distinguishes limburgites, basalts and nepheline-basalts. All are porphyritic, with olivine, augite and labradorite (in the plagioclastic varieties) as phenocrysts in a groundmass of augite, plagioclase, probably sanidine, magnetite, ilmenite, hematite, mica and apatite in the feldspathic rocks and in the nepheline basalts with a groundmass of much the same character except that nepheline replaces the feldspar. Besides, a little glassy base is always present. Some of the olivine is brecciated as if broken by the movement of the rock in which it occurs. Again it is corroded, when it is often surrounded by a rim of glass, which the author thinks is due to rapid cooling of the dissolved portion of the mineral. The augites are often zonal, with the deeply colored zones within in the plagioclase basalts, and in the nepheline varieties with the lighter colored zones in the interior. The nepheline present in the nepheline basalts is either in the form of a uniformly distributed groundmass in which are imbedded microlites of augite or in little nests between the other minerals, or finally as small areas with crystal cross sections. Mellilite was detected in a nepheline basalt and good plates of pleochroic ilmenite were observed in several plagioclase basalts. Glass was present in the limburgite, in several plagioclase basalts and in one nephelinic variety. Quartz fragments included in the plagioclase basalts are surrounded by rims of augite crystals, between which and the nucleus is often a zone of glass. Sometimes the quartz has entirely disappeared, leaving only glass encircled by a crown of augite. Analyses of all the varieties of the rocks studied accompany the paper.

The Rocks of the Piedmont Plateau.—In an excellent article on the structure of the Piedmont Plateau in Maryland, G. H. Williams[2] divides the region between the Catoctin Mountains and the

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[1] Zeits. d. d. Geol. Ges. xliii, p. 43.

[2] Bull. Geol. Soc. Amer., Vol. ii, p. 301.

Costal area into two parts, a Western one underlain by fragmental rocks in which but slight alteration has been effected, and an Eastern one characterized by both sedimentary and eruptive rocks that have been strongly metamorphosed by pressure. In the first area phyllites, including sericite, chlorite and ottrelite schists, sandstones made up of undoubtedly clastic grains, and a few crystalline limestones occur. In the Eastern area the piedmont rocks are gneisses, some of which are evidently eruptive and others probably sedimentary; quartzites and quartzite-schists, in which all evidences of fragmental origin have disappeared, coarse crystalline marbles containing phlogopite, tremolite, scapolite, etc., and acid and basic eruptives. Each of these classes, except those belonging to the eruptive division, is briefly characterized, and pictures[1] of the sandstone of the Western area and of the quartzite of the Eastern area are given for comparison.

The Diorite of the Andes, first mentioned by Stelzner as a characteristic rock of this mountain range, has been closely studied by Möricke[2] in the occurrence at St. Cristobal near Santiago in Chile. It is closely associated with andesites, both hornblendic and augitic, with propylite and tufas, in such a way that the author is led to look upon them all as facies of the same rock mass, the diorite representing the deep-seated phases and the andesites the surface flows. The hornblende, augite and hypersthene-augite, andesites and the diorites have the usual characteristics of these rocks. With respect to structure an intermediate phase occurs in the propylite, which consists of phenocrysts of plagioclase and green hornblende in a ground mass of plagioclase, chlorite and epidote. The propylite is much altered, while the other rocks are fresh. The geological relations of the different rock types correspond with the conclusions outlined as above. The 'stocks' of diorite, often forming the peaks of the range, are the denuded cones of old massifs.

The Porphyry of Monte Doja.—Pelikan[3] has re-examined the rock discovered by Suess at Monte Doja, in the Adamello group of mountains, and described by him as a reddish brown porphyry. The structure is porphyritic and the groundmass is dark brownish red in color. Under the microscope the thin section shows a colorless base containing yellowish-brown wisps of biotite, thin prisms and fine

[1] C. R. Keyes, Ib. p. 321.

[2] Min. u. Petrog. Mitth. xii, p. 143.

[3] Min. u. Petrog. Mitth., xii, p. 156.

needles of rutile and six-sided prisms of tourmaline. The colorless mass in which these are imbedded contains plagioclase, orthoclase and quartz. The porphyritic crystals in this groundmass are cordierite. They all possess a more or less hexagonal cross section, and the usual optical properties of the mineral. Its inclusions are biotite plates and rutile, and tourmaline crystals like those of the groundmass. The composition of the rock is represented by the figures:

SiO_2	TiO_2	Fe_2O_3	Al_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O
56.88	2.66	20.86	4.54	1.29	3.15	7.48	.90	2.36	

Corresponding to 18% of cordierite, 20% of mica, 30% of orthoclase and 13% of plagioclase. The origin of the rock is unknown.

Wernerite Rocks occurring at several places in the Pyrenees are stated by Lacroix[1] to be altered feldspathic eruptives. The original form of the varieties from Sallix and Ponzac was a hornblende diabase containing olivine, biotite and sphene. The borders of the feldspar, which is labradorite, are often fringed by little plates of dipyr. Veinlets of these penetrate the plagioclase until in some cases all the labradorite is replaced by large plates of the scapolite, many of which are of much larger size than the feldspars from which they were formed. They moreover possess a uniform orientation over large areas, so that the structure of the rock passes from the microlitic to the granular. When dynamic agencies have modified it broken pieces of the scapolite are often found. This indicates to the author that in these cases the alteration of the feldspar preceded the crushing. On the other hand, broken pieces of all the other minerals are sometimes found cemented by unbroken dipyr, in which case the formation of the latter mineral was subsequent to the shattering. The alteration is thus a strictly chemical process. The paper closes with a reference to the Norwegian scapolite rocks and their comparison wth those of the Pyrenees.

Petrographical News.—The phonolites[2] of Montusclat and of Lardeyrols in the Ardennes, in France, contain small crystals and crystallites of låvenite, the latter often grouped into forms resembling the skeletons of large crystals. The larger crystals are golden yellow, with a strong pleochroism.

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[1] Bull. Soc. Franc., d. Min. xiv, p. 16.

[2] Lacroix. Ib., xiv, p. 15.

Anatase and brookite are described[1] as occurring in French rocks, the former in the mica porphyrites of Pranal, Puy-de-Dom, and the latter in the chloritized mica of the limestone of Ville-es-Martin, in the Loire-Inférieure, and in the mica of a mica porphyrite from Pouchon, in Cercie, and in the granite of Lacourt, Ariège.

The same author[2] announces the discovery of octahedra of cristobalite associated with tridymite in a piece of quartz inclusion from the basalt of Mayen in Rhenish Prussia.

Nova Scotian Gmelinite.—A careful analysis of *gmelinite* from the Five Islands, Nova Scotia, has been made by Pirsson,[3] and the properties of the mineral have been investigated. The mineral occurs in seams in a decomposed trap. In thin sections its crystals are found to be composed of a colorless compact outer zone enclosing a flesh-colored, friable inner nucleus. Their habit is short pyramidal, and their axial ratio $a : c = 1 : .7345$. Two methods of twinning were observed, viz., interpenetration twinning with oP the twinning plane, and contact twinning parallel to $\frac{3}{2}$R. The double refraction is weak and negative, with $\omega - \varepsilon$ for sodium light = .0033. Density = 2.037, and composition :

SiO_2	Al_2O_3	Fe_2O_3	CaO	K_2O	Na_2O	H_2O
50.35	18.33	.26	1.01	.15	9.76	20.23

The author regards the mineral as a sodium-chabazite, in which Na : Ca = 8 : 1. The sodium is thought to exert a marked morphotropic action, since the crystallographic planes of the gmelinite cannot be conveniently referred to the axes of chabazite. It may, therefore, be considered as a distinct mineral species.

Crystallography of Cerussite, etc.—Pirsson[4] also contributes a few crystallographic notes on *cerussite, gypsum* and *krämmerite.* Twinned crystals of the first-named mineral from the Red Cloud Mine, Ariz., are arrow-shaped, with the plane $\infty \breve{P}3$ the twinning plane. The gypsums are from Girgenti, Sicily. They are twinned according to the usual law, but $\frac{1}{3}P\overline{\infty}$ so largely predominates over other forms that they resemble basal planes and cause the twinned crystals to resemble in symmetry an orthorhombic form. The krämmerite studied is from

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[1] Lacroix. Ib., xiv p. 191.

[2] Ib., xiv, p. 185.

[3] Amer. Jour. Sci., July, 1891, p. 56.

[4] Amer. Jour. Sci., Nov., 1891, xlii, p. 405.

Texas, Pa., and is the same as that examined by Cooke[1] in 1867. Three new forms were observed on it, viz.: $\infty P2$, $\frac{1}{2}P2$ and $\frac{1}{3}P$. The prism $\frac{1}{2}P2$ is very characteristic and is seldom wanting. The author also corrects the axial ratio for *mordenite* to $a : b : c = .401 : 1 : .4279$. $\beta = 88° 29' 46''$, and briefly describes skeleton crystals of *hematite* from Durango, Mex., filled with cassiterite and pseudomorphs of the latter mineral after the former.

Mineralogical News.—Dr. Hoffman[2] mentions a quartzite from the North shore of St. Joseph Island, in Lake Huron, whose joint planes are coated with limonite containing numerous tiny spherules composed of a nucleus of silica, coated with a humus-like substance, which in turn is overlain by a layer of metallic iron. The spherules form 58.85% of the mixture. They have a density of 6.8612 and the following composition: Fe = 88.00; Mn = .51; Ni = .10; Co = .21; Cu = .09; S = .12; P = .96; C = ?; insol. res. = 9.76. The insoluble residue consisted of little concentric bodies with the composition: $SiO_2 = 93.95$; $Al_2O_3 = 1.13$; $Fe_2O_3 = 1.02$; CaO = .62; Mg = .31; Loss = 2.97.

Analyses of uraninite from two new localities are given in a recent paper by Hillebrand[3]. The first is that of a specimen obtained from Marietta, Greenville Co., S. C., and the other that of one from the Villeneuve Mine, Ottawa, Quebec. Neither of the two was pure.

	UO_3	UO_2	ThO_2	ZrO_2	CeO_2	(La. etc.)	Yt. etc.	CaO	PbO	H_2O
S. C.....		83.95	1.65	.20	.19	2.05	6.16	.41	3.58	und.
Que.....	41.06	34.67	6.41	?	.40	1.11	2.57	.39	11.27	1.47

	N	SiO_2	Insol.	Fe_2O_3	X
S. C....................	undet		.20	tr.	tr.
Que....................	.86	.19	.13	.10	.09

Results of the analyses of the same mineral from Llano Co., Texas, and from Johann-georgenstadt, Sax., show the presence of nitrogen in each.

Williams[4] has discovered *anatase* crystals in a jointed slate from five miles South of Bremo Bluffs, Buckingham Co., Va. The crystals are small and are associated with pyrite and quartz, which cover the faces of the joint cracks. P and oP are the only faces observed on the anatase.——Crystalline masses of *ilvaite* are reported by Hoffman[1] from a twenty-foot vein near the head of Barclay Sound, Vancouver Island, British Columbia. Its hardness is 5.5, density 3.85 and composition:

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[1] Ib., 1867, xliv, p. 201.

[2] Amer. Geol., viii, p. 105.

[3] Amer. Jour. Sci., Nov., 1891, p. 391.

[4] Ib., Nov., '91, p. 431.

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	H_2O
29.81	.16	18.89	32.50	2.22	13.82	.30	1.62

Celestite from Scharfenberg, near Meissen, Saxony, according to Stuber[2] occurs in druses of little blue crystals whose axial ratio is .7807 : 1 : 1.2834, and whose habit is determined by the planes $P\breve{\infty}$, oP and $\frac{1}{2}P\bar{\infty}$. Another druse is made up of brown or wine-yellow crystals whose habit differs from that of the blue crystals in that oP is small. Their axial ratio differs also, since $a : b : c = .7834 : 1 : 1.2962$.

Weed and Pirsson[3] describe orthorhombic crystals of *sulphur* from around the vents at the Highland Hot Springs and at Crater Hills in the Yellowstone National Park, and stalactitic and fibrous growths of orpiment and realgar in crevices of the rock surrounding vents in the Western part of the Morris Geyser Basin in the same territory.

Nesquehonite exists in the anthracite mine of Mure, Isère. Its analysis by Friedel[4] gives results that prove its identity with the nesquehonite of Genth and Penfield.

Syntheses.—While heating mica with soda and sodium sulphate in a tube the mixture became dry, leaving a residue in which the Messrs. Friedel[5] discovered little rhombohedra, with the composition of *nosean.* Upon heating mica, soda and sodium carbonate for two days at 500° the same experimenters obtained little hexagonal pyramids of a substance with the composition $3\ (2\ SiO_2,\ Al_2O_3,\ Na_2O) + Na_2\ CO_3 + 2H_2O$, which the authors regard as a calcareous rich cancrinite. If amorphous alumina be heated at 530° in a solution of soda in a closed tube the excess of the first material will separate[6] upon cooling as *corundum.* If heated at 400° *diaspore* is produced. When the soda contains a little aluminum and calcium carbonates, *calcite* crystals accompany the corundum. These experiments throw some light upon the production of corundum in metamorphosed limestones. Under similar conditions magnesia yields *brucite.* When calcium silicate is treated with sodium borate at high temperatures under pressure *datholite* crystals are formed, according to Wyrouboff.[1]

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[1] Ib., Nov., '91, p. 432.

[2] Zeits. f. Kryst., xix, 1891, p. 437.

[3] Ib., Nov., 1891, p. 401.

[4] Bull. Soc. Franc. d. Min., xiv, p. 60.

[5] Bull. Soc. Franc. d. Min., xiv, p. 69.

[6] G. Friedel. Ib., xiv, p. 7.

Miscellaneous.—A new contribution to the discussion of the cause of optical anomalies is from the pen of Karnojitzky[2], who ascribes the phenomena to polymerism. Paramorphic substances are thought to be polymeric, with the higher polymer more stable than the simpler one. The latter usually possesses a higher degree of symmetry than the former, and hence, when it forms first it gives a higher degree of symmetry to its crystals than is possessed by those of its paramorph—the more stable, more complicated compound. The author develops this idea in a very logical and clear manner, and instances many examples to indicate the probability of the correctness of his statements.

Retgers[3] proposes to test the isomorphism of different substances by forming of them mixed crystals, which, if the two substances used be isomorphous, will differ continuously in their physical properties. In the case of colored salts the test most easily applicable is that of color. If potassium chlorate and the corresponding permanganate be dissolved in water and a drop of each be placed in an object glass and allowed to come in contact, the crystals formed at the junction of the two drops will be intermediate in color between those formed at a distance from it. In the case of salts that are not isomorphous no gradation in color will be observed. In his article the author mentions the many compounds that he has discovered to be isomorphous.

Lemberg[4] suggests a modification of micro-chemical analysis by which minerals are detected rather than their constituent elements. For instance, instead of distinguishing between hauyne and sodalite by studying their elements, the author would study the effect of the minerals themselves upon reagents, *e. g.* sodalite will precipitate silver chloride from a weak nitric acid solution of silver nitrate, whereas hauyne will not do so. Chabazite reacts rapidly with ammonium chloride and generates ammonia, while thomsonite, analcite and leucite are without effect upon it of any kind. The principal minerals studied by the author that yield definite and distinctive results are hauyne, sodalite, scapolite, chabazite, calcite, witherite, cerussite and anglesite and others of less importance. The method of manipulation necessary to produce good results is described in each case with great minuteness.

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[1] Ib., xiv, p. 197.

[2] Zeits. f. Kryst, xix, p. 571.

[3] Zeits. Physik. Chem., viii, July, 1891, p. , and Jour. Chem. Soc., lx, p. 1151, Cf.; also Lehmanne Die Krystallanalyse, p. 57.

[4] Zeits. d. d. Geol. Gesele., xlii, 1891, p. 737.

Dufet[1] describes a method for the determination of the comparative values of the indices of refraction by means of the prism and total reflection, and Lavenir[2] gives an account of a new process by which the optical orientation of any crystal may be determined.

A report on "The Mineral Resources of the Province of Quebec," by Ells[3], contains a history of the various mining industries of the district. In the same annual report Hoffmann[4] publishes a list of the minerals occurring in Canada, and Ingalls[5] gives statistics relating to the production and exportation of the mineral products of Canada.

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[1] Bull. Soc. Franc. d. Min., xiv, p. 130.

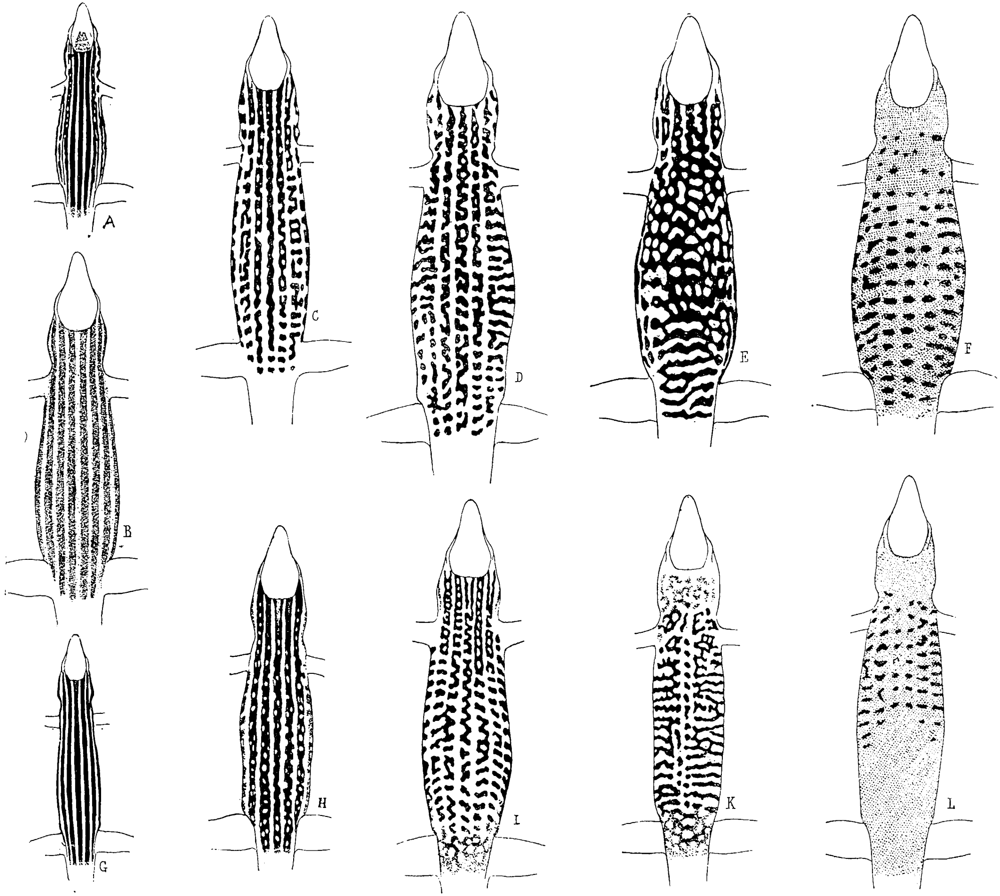
[2] Ib., xiv, p. 100.

[3] Pt. K. Ann. Rep. Can. Geol. Survey, 1888–89.

[4] Pt. I. Ib.

[5] Pt. S. Ib.

PLATE XVIII.



A–F, *Cnemidophorus tessellatus.* G–L, *C. gularis.*